MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2015/2016

DET5078 – ANALOG ELECTRONICS 2

(Diploma in Electronics Engineering)

11 MARCH 2016
9 AM – 11 AM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This booklet consists of 5 pages with **5 questions** only excluding the cover.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the answer booklet provided. All necessary working **MUST** be shown in the answer booklet.

QUESTION 1 [20 marks]

(a) List down **THREE** advantages and **TWO** disadvantages of JFET. (5 marks)

(b) Based on the Figure 1(a) below, **explain** in detail the biasing process to TURN ON a NPN Enhancement Mode MOSFET. (5 marks)

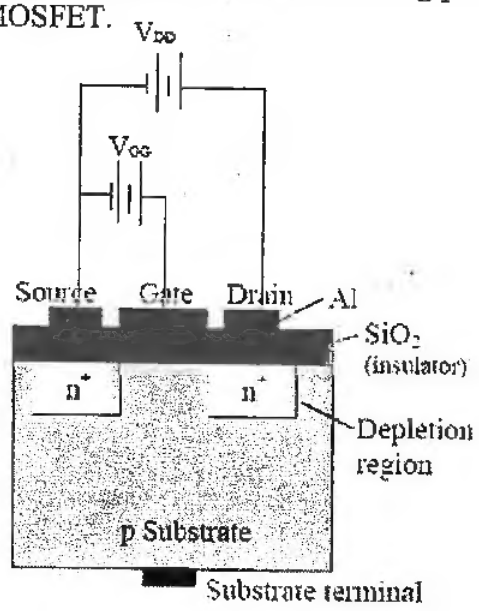

Figure 1(a)

(c) A JFET transistor circuit is shown in Figure 1(b):

Given $R_D = 5K\Omega$, $R_G = 1M\Omega$, $V_{DD} = 16V$, $V_{GG} = 5V$, $I_{DSS} = 10mA$ and $V_p = -8V$, find the following:

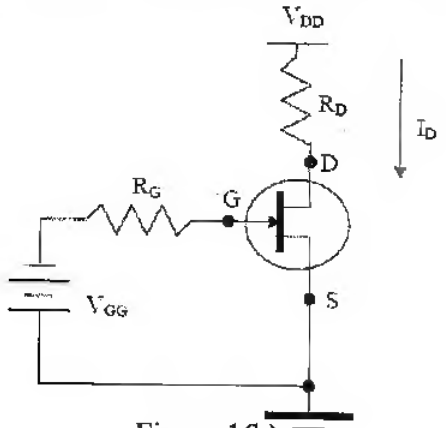

Figure 1(b)

(i) V_{GSQ} and I_{DQ} (4 marks)

(ii) V_{DS} and V_D (4 marks)

(iii) V_G and V_S (2 marks)

Continued .....

QUESTION 2 [20 marks]

(a) Explain the term "biasing a transistor". (3 marks)

(b) Miller Theorem is used in constructing a BJT or FET high frequency model. Briefly explain the theorem with aid of an illustration. (7 marks)

(c) Figure 2 shows a high frequency model of a FET Common Source Amplifier.

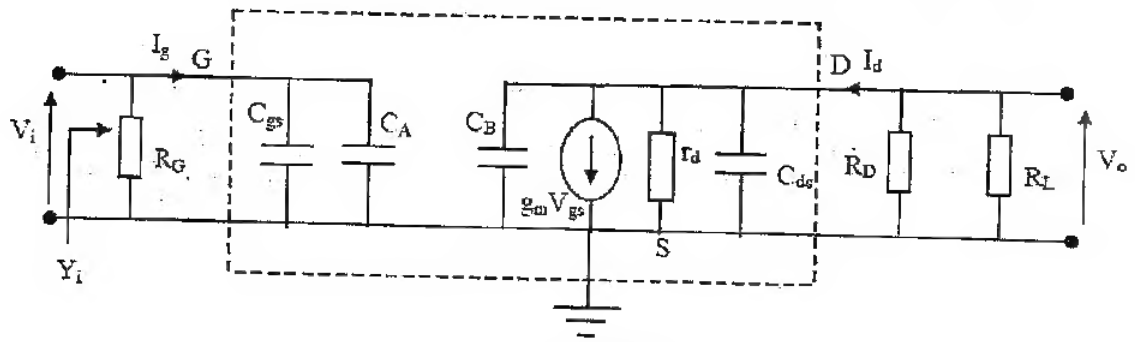

Figure 2

It has a R_G = 1MΩ, R_D = 50 kΩ, R_L = 6kΩ and operates up to 50 kHz. The FET parameters are g_m = 5 mA/V, r_d = 50 kΩ, C_{gs} =3pF, C_{ds} = C_{gd} = 1pF. The coupling and bypass capacitors have large values of capacitance. Calculate the following:

(i) Y_{gs} (1 mark)

(ii) Y_{ds} (1 mark)

(iii) G_G (1 mark)

(iv) G_D (1 mark)

(v) G_L (1 mark)

(vi) g_d (1 mark)

(vii) $|A_v|$ (4 marks)

Hint:

$G_G = 1/R_G$, $G_D = 1/R_D$, $G_L = 1/R_L$, $g_d = 1/r_d$

$Y_{gs} = j\omega C_{gs}$, $Y_{ds} = j\omega C_{ds}$, $Y_{gd} = j\omega C_{gd}$

$Y_A = Y_{gd}(1 - A_V)$, $Y_B = Y_{gd}(1 - 1/A_V)$ $Y_A = j\omega C_A$, $Y_B = j\omega C_B$

$C_A = C_{gd}(1 - A_V)$, $C_B = C_{gd}(1 - 1/A_V)$

$$A_V = \frac{-g_m + Y_{gd}}{Y_{gd} + g_d + Y_{ds} + G_D + G_L}$$

Continued .....

QUESTION 3 [20 marks]

(a) An output waveform of a Class A amplifier is not an exact replica of the input signal waveform due to various types of distortion. Briefly explain the types of distortion below:

(i) Amplitude Distortion (2 marks)

(ii) Frequency Distortion (2 marks)

(iii) Phase Shift Distortion (2 marks)

(b) Figure 3 shows an output waveform of an amplifier.

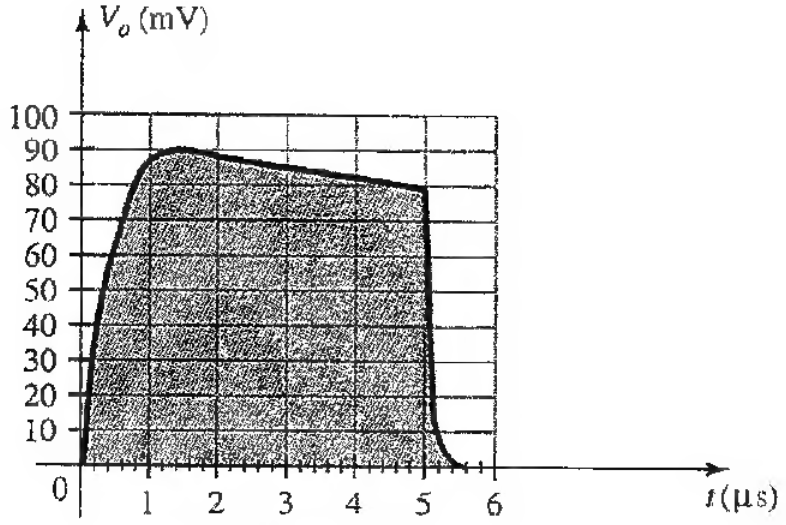

Figure 3

The input of the amplifier is a 20mV, 180kHz square wave signal. Based on Figure 3, calculate for the following parameters:

(i) Upper cutoff frequency (5 marks)

(ii) Lower cutoff frequency (4 marks)

(c) A type of RC circuit has a critical frequency at $f_c = 888$ Hz, above which the attenuation is approaching 0 dB. Determine the dB attenuation at 88.8 Hz. (5 marks)

Continued .....

QUESTION 4 [20 marks]

(a) Based on the Figure 4(a), **explain** in detail and **illustrate** a waveform for a type of distortion called "crossover distortion" which is experienced by a Class B amplifier. (10 marks)

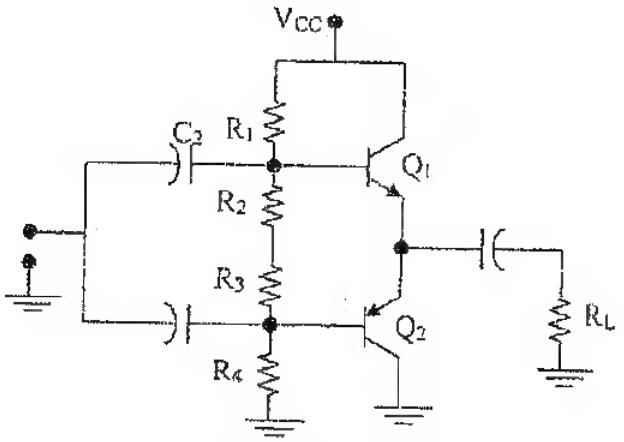

Figure 4(a)

(b) Figure 4(b) shows a class B amplifier circuit.

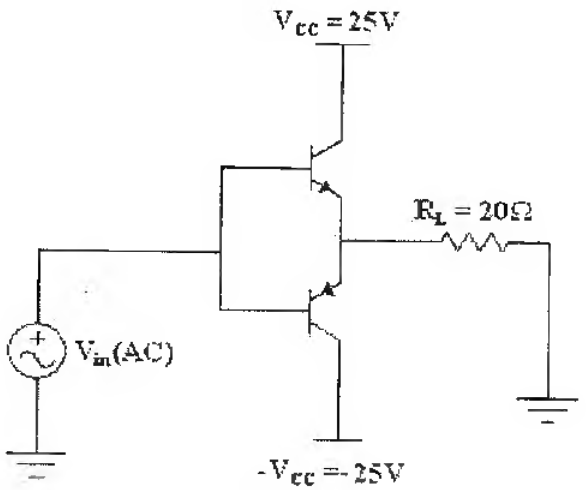

Figure 4(b)

The Class B amplifier provides 20V peak signal to a 20Ω load. Find the following:

(i) Input power (6 marks)

(ii) Output power (2 marks)

(iii) Circuit efficiency (2 marks)

Continued .....

QUESTION 5 [20 marks]

(a) Based on the below Schmitt Trigger circuit that would exhibit switching characteristics as shown in Figure 5 with $R_{f1} = 3k\Omega$, $R_{f2} = 7k\Omega$, $R_i = 5k\Omega$ and supply voltages are ±12V. Assume that the load resistance is greater than 2KΩ.

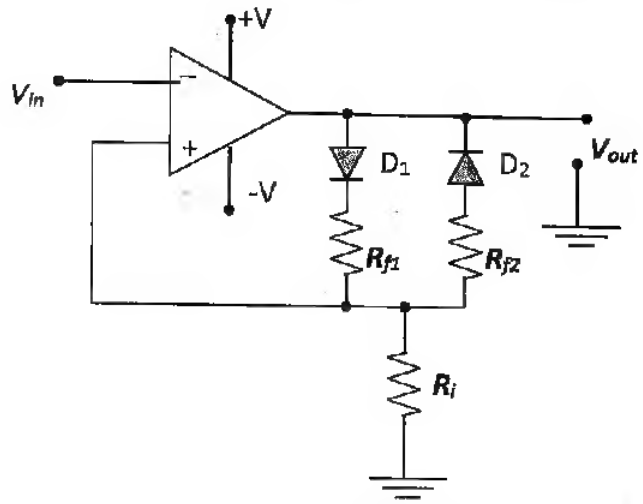

Figure 5

(i) State the type of the Schmitt trigger (1 mark)

(ii) Determine the UTP and LTP (6 marks)

(iii)Sketch the input signal and output signal if input signal V_{in}= 8sin(πt) is applied to the Schmitt Trigger in Figure 5. (4 marks)

(b) Briefly explain about astable, monostable and bistable multivibrators. (6 marks)

(c) Name THREE applications of the Astable Multivibrator. (3 marks)

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